

# STEREO Beacon

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**O. C. St. Cyr**

The Catholic University of America

NASA-Goddard Space Flight Center

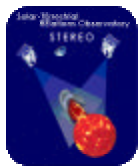
(301) 286-2575 [cstcyr@grace.nascom.nasa.gov](mailto:cstcyr@grace.nascom.nasa.gov)

**J. M. Davila**

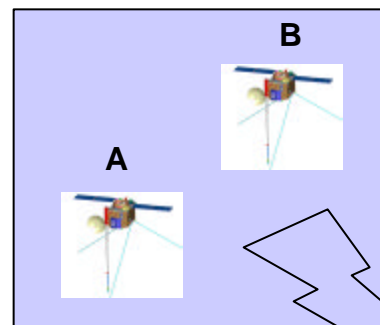
NASA-Goddard Space Flight Center

(301) 286-8366 [davila@stars.gsfc.nasa.gov](mailto:davila@stars.gsfc.nasa.gov)

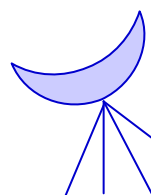




# STEREO as ILWS Test-bed?



NASA will provide two spacecraft that continuously transmit space weather measurements to a ground processing facility



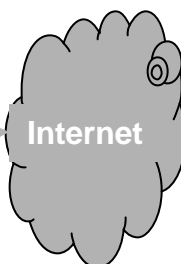
DSN

3 hours per day



21 hours per day

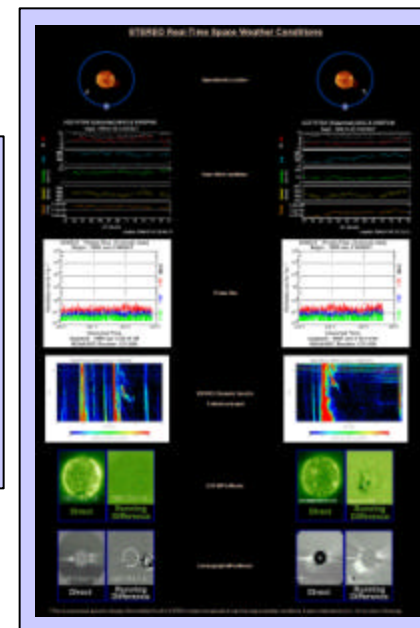
Antenna Partners



Internet

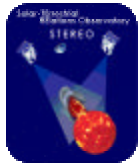
STEREO  
Science  
Center  
NASA-GSFC

In Search Of:  
Antenna Partners



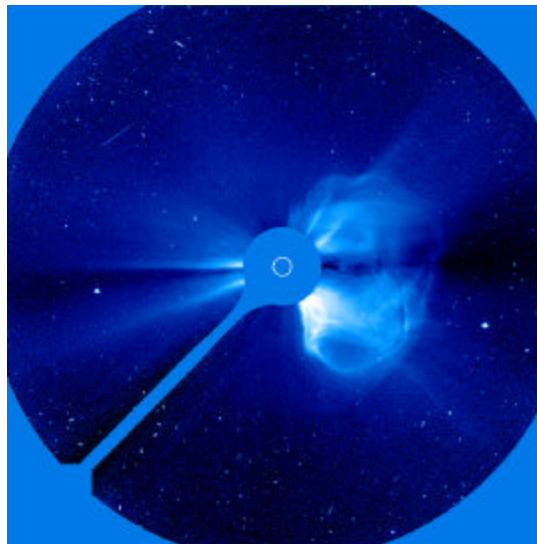
Real-time Space Weather  
Display and Archive





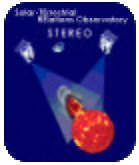
# Solar-Terrestrial Relations Observatory (STEREO)

	Science Objectives
1	Understand the causes and mechanisms of CME initiation.
2	Characterize the propagation of CMEs through the heliosphere.
3	Discover the mechanisms and sites of energetic particle acceleration in the low corona and the interplanetary medium.
4	Improved determination of the structure of the ambient solar wind.



**SOHO  
LASCO C3**

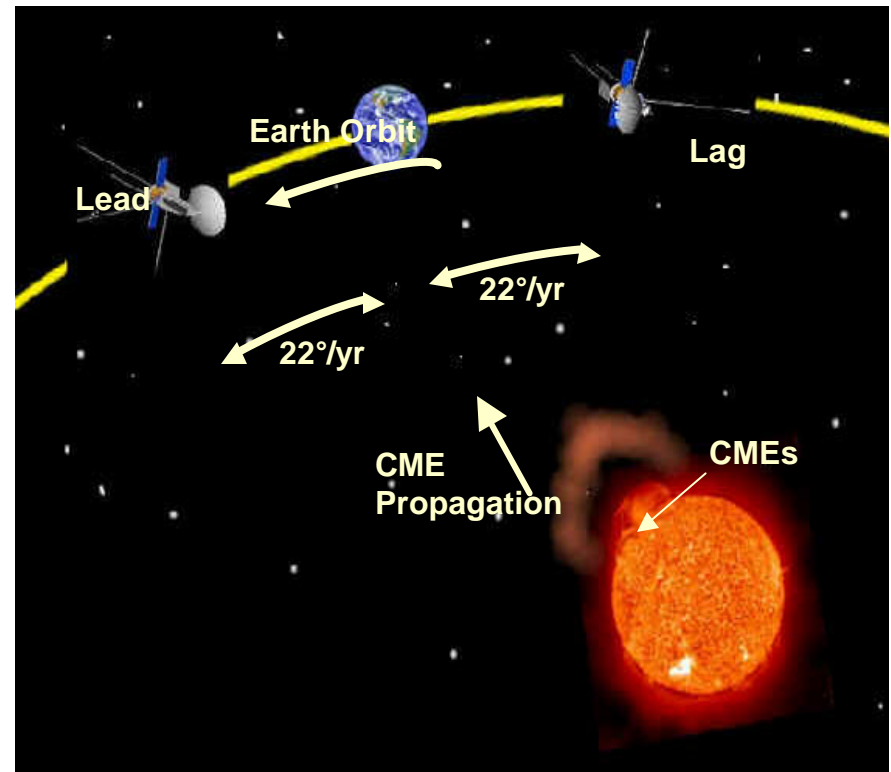


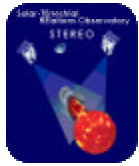


# STEREO

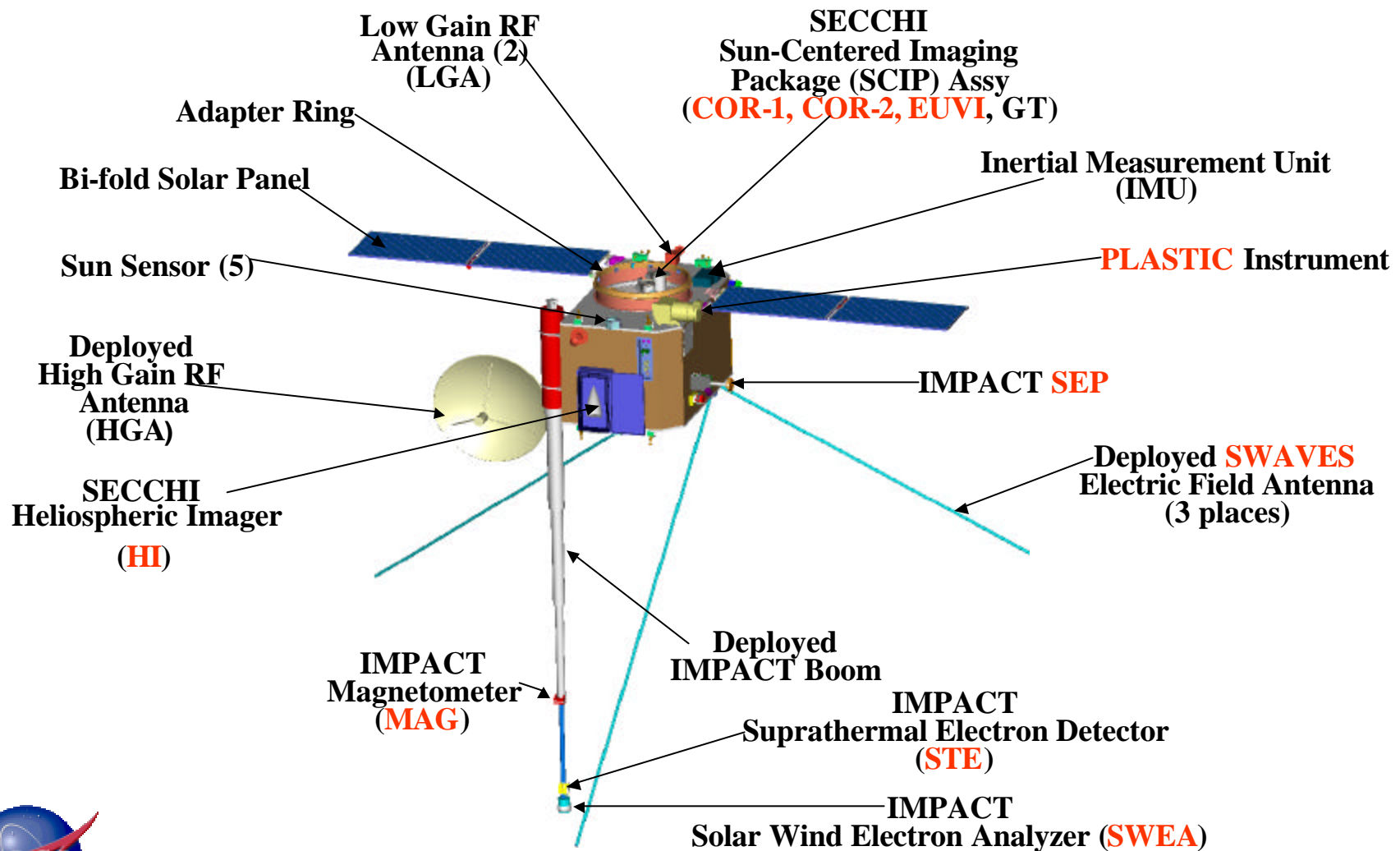
## Launch November 2005

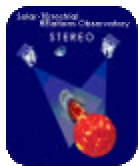
- Two Identical Spacecraft
- Heliocentric Drift Orbits at 1 AU
  - One Ahead of Earth (STEREO-A)
  - One Behind Earth (STEREO-B)
- $22^\circ/\text{year}$  drift from Earth
- Single Delta II 2925–10L launch vehicle with stacked configuration
- Two Year Nominal Mission.  
Additional 3 Years' Expendables.





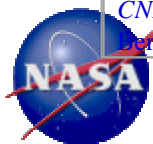
# STEREO Spacecraft

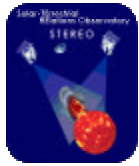




# STEREO Payload

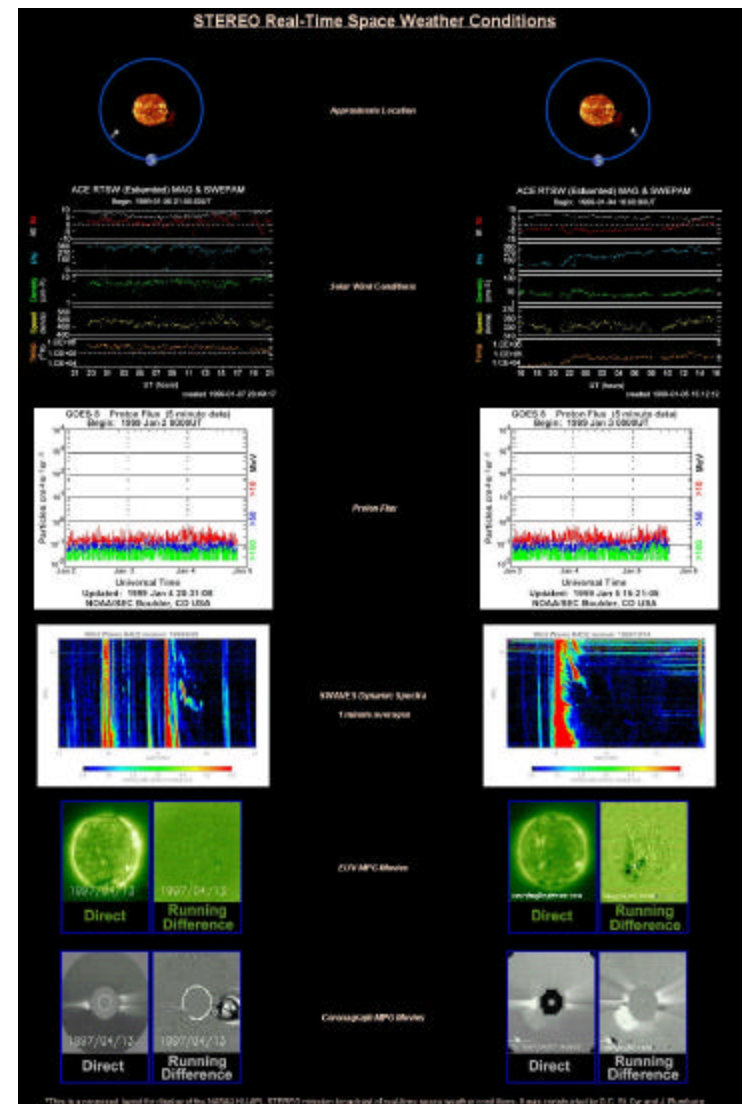
Instrument Name and Collaborating Institutions	Primary Measurement And Space Weather Beacon Content
<p><b><u>IMPACT</u></b> (<i>In situ</i> Measurement of Particles and CME Transients)</p> <p><i>Principal Investigator: Dr. J. G. Luhmann,</i> University of California, Berkeley, NASA-GSFC, Caltech, U. Md, U. Kiel, CESR, MP Ae, JPL, ESTEC, UCLA, NOAA, LANL, et al.</p>	<p>Solar wind plasma characteristics; magnetic field parameters; solar energetic particles</p> <p>One minute average solar wind electron fluxes (6 energy bands); magnetic field strength and direction; energetic electron, proton, ion (He, CNO, Fe) fluxes (multiple bands)</p>
<p><b><u>PLASTIC</u></b> (<b>PL</b>Asma and <b>SupraThermal Ion and Composition</b>)</p> <p><i>Principal Investigator: Dr. A. B. Galvin</i> University of New Hampshire University of Bern, MPE-Garching, et al.</p>	<p>Ions in the energy-per-charge range of 0.2 to 100 keV/e</p> <p>One minute average solar wind proton density, bulk speed, thermal speed, and direction; alpha density; representative charge (or abundance) state distributions; suprathermal rates</p>
<p><b><u>SECCHI</u></b> (<b>Sun-Earth Connection Coronal and Heliospheric Investigation</b>)</p> <p><i>Principal Investigator: Dr. R. A. Howard</i> Naval Research Laboratory, Washington, D.C. Lockheed-Martin Solar and Astrophysics., NASA-GSFC, University of Birmingham (U.K.), IAS, RAL, MP Ae, U. Kiel, CSL, et al.</p>	<p>EUV imager, two coronagraphs with overlapping fields of view; two heliospheric imagers with overlapping fields of view</p> <p>256x256 pixel highly compressed images from EUVI, COR1, COR2, HI1, HI2</p>
<p><b><u>S/WAVES</u></b> (STEREO/WAVES)</p> <p><i>Principal Investigator: Dr. J.-L. Bougeret</i> CNRS, Observatoire de Paris, University of Minnesota, UC Berkeley, NASA-GSFC</p>	<p>Interplanetary radio bursts from 40 kHz to 16 MHz</p> <p>One minute average radio dynamic spectrum (Intensity, frequency, time)</p>



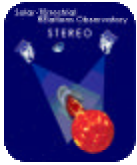


# STEREO Space Weather Beacon

- Each STEREO spacecraft will broadcast highly compressed SWx images and *in situ* data continuously.
- During the daily 3-hour DSN contacts, the SWx stream will be captured, processed, and put online in near-real-time at the STEREO Science Center (SSC) located at NASA-GSFC.
- As soon as the recorder dumps are available, the SSC will fill in the previous 24 hours' SWx data as a browse archive.



This is a proposed layout for display at the NASA GSFC STEREO mission broadcast of real-time space weather conditions. Data contributed by D.C. St. Cyr and J. Rumbolt.

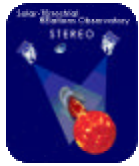


# Potential Antenna Partners

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- **Rutherford Appleton Labs (U.K.) ACE antenna**
  - Upgrade to X-band underway
  - Technical interface discussions with SSC start soon
- **NOAA Space Environment Center**
- **U.C. Berkeley (STEREO PI team)**
  - RHESSI antenna requires upgrade to X-band
- **CRL (Japan)**
  - Budget and technical feasibility studies are underway
- **Germany (GSOC request through University of Kiel)**
- **Brazil**
- **ESOC/ESA has a network of 15m X-band antennas with significant spare capacity (estimated ~200 hours per week)**



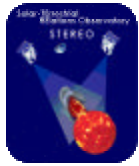


# What Do Antenna Partners Need?

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- **X-band dish and receiver**
  - 7 meter dish covers 2-year nominal mission
  - 15 meter dish covers 5-year extended mission
- **Low data rate Internet connection during telemetry reception periods**
  - TCP/IP socket, email, ftp, etc.
- **Beacon description reprints available**
- **<ftp://stereo.gsfc.nasa.gov/pub/cstcyr/STEREO/>**





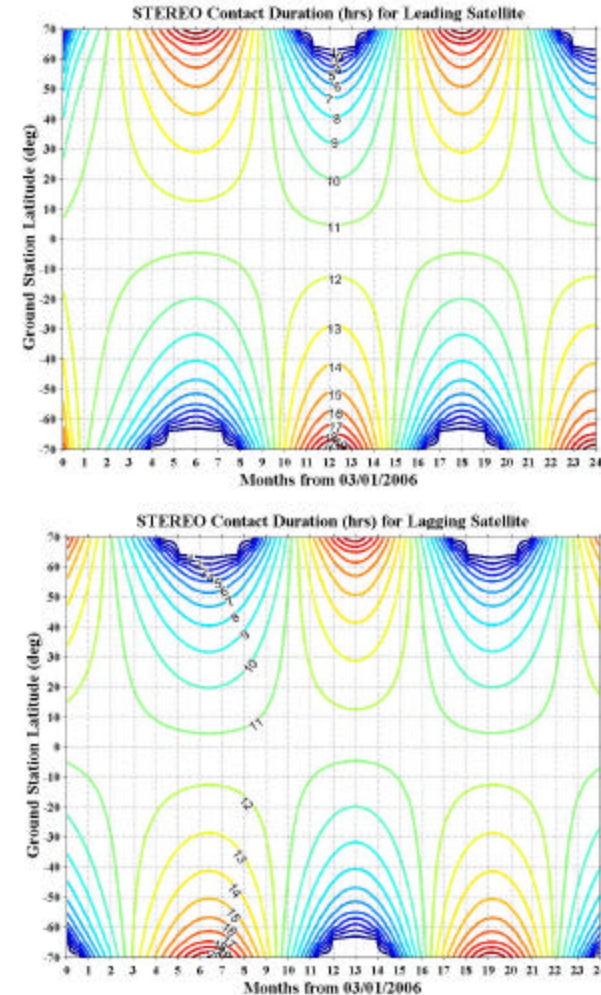
# Antenna Contact Duration

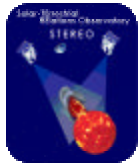
## (latitude versus time)

For a single mid-latitude location on Earth, the two STEREO spacecraft will be seasonally out-of-phase

Example using RAL, U.K. (lat. +51°)

	STEREO-A	STEREO-B
March 2006	6 hours/day	15 hours/day
Sept 2006	15 hours/day	6 hours/day
March 2007	6 hours/day	15 hours/day





# STEREO Beacon Focused Workshop

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**Science Organizing Committee:** Co-Chairs: St.Cyr (CUA) and Luhmann (UCB)  
Pizzo (NOAA SEC), Zwickl (NOAA SEC), Kunches (NOAA SEC), Goodrich (UMd),  
Davila (NASA-GSFC), TBD (USAF-NOAA liaison)

**Dates:** Tuesday, March 4, 2003, to Thursday, March 6, 2003

**Location:** NOAA Space Environment Center, Boulder, CO

**Attendance:** 30-50 participants

**Primary Goal:** How can we insure that the STEREO real-time space weather beacon will be useful to NASA, NOAA SEC, the USAF, and to the community?

**Challenges:**

- Non-L-1 measurements
- Moving, non-L-1 measurements
- Remote sensing and radio will be available
- Data coverage
- Test bed for future LWS missions

